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IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF ALASKA AT ANCHORAGE

ENOCH ADAMS, JR., LEROY ADAMS, ANDREW KOENIG, JERRY NORTON DAVID SWAN and JOSEPH SWAN,

Plaintiffs,

v.

TECK COMINCO ALASKA INCORPORATED

Defendant.

NANA REGIONAL CORPORATION and NORTHWEST ARCTIC BOROUGH,

Intervenors-Defendants.

Case No. A04-49 (JWS)

EXPERT DECLARATION OF KEN FUCIK

NO DOCKETING REQUIRED
Initials
Date 1/29/08

I, Ken Fucik, declare:

1. I am over 18 and not a party to this action.

Qualifications

2. I am a specialist in water quality and aquatic toxicology and founder and General Manager of The SeaCrest Group. I hold a Bachelor of Science degree in Zoology from Texas Tech University and a Master of Science in Biological Oceanography from Texas A&M University. I am also a founder and current President of the Board of Envirolab Peru, an environmental chemistry laboratory in Lima, Peru.

3. I have more than thirty-two years of domestic and international experience in conducting and managing environmental studies for industrial and municipal clients, law firms, and government agencies. I have performed laboratory and field studies on the effects of organic and inorganic contaminants in freshwater and marine environments. These studies have investigated impacts of permitted and accidental discharges from mines, oil and gas wells, refineries, power plants, manufacturing facilities and municipal wastewater plants, among others.

4. I have taught courses to technical and general audiences, and have given expert testimony on various types of projects. I have worked on projects in Australia, Argentina, Mexico, Peru, Great Britain, Russia, Equatorial Guinea, Colombia, Indonesia, Bangladesh, and the United States.

5. In recent international work, I provided expert technical support to investigate the environmental and human health effects of organic and inorganic contaminants on surface waters following a gas well blowout in Bangladesh. I have investigated the transport and fate of metals and hydrocarbons in surface waters of the Peruvian Amazon. I have studied the effects of oil and

dispersed oil on fish and invertebrates of the Java Sea, Indonesia. In the North Sea, I have investigated the food chain effects of contaminants in cuttings piles. For a multibillion dollar industrial project in Russia, I have been involved in developing the construction and operations monitoring plans.

6. I have conducted and/or directed thousands of biomonitoring studies at mining and industrial sites across the United States. As part of these investigations, I have directed projects supporting the design of water treatment facilities for operating mines and those undergoing Superfund cleanups, including the Argo Tunnel and Summitville Mines in Colorado. I also conducted studies to support engineers involved in designing a treatment process for metals contaminated effluents at the Rocky Mountain Arsenal. I have also directed and conducted biomonitoring tests under NPDES guidelines for numerous metals mines and coal mines in Colorado, South Dakota, Utah, Nevada, and Idaho. I was appointed to a citizens committee to advise county and state government on designation of Superfund status for a historic mining district in the Lefthand Watershed, Colorado. I am currently a member of the board of the Lefthand Watershed Oversight Group advising EPA and the Colorado Department of Public Health and Environment on ongoing studies in the watershed. I have collected water samples within this and other watersheds which were used in biomonitoring testing to determine the effects of acid mine drainage from abandoned mining operations. Additionally, I have conducted numerous investigations to identify causes of toxicity associated with high total dissolved solids (TDS) concentrations. These studies have been conducted for mines, municipalities, refineries, produced water discharges from oil and gas wells, and for water treatment facilities using membrane technology under funding from the American Waterworks Research Foundation.

7. I have worked for numerous companies such as the Minerals Management Service, Bureau of Reclamation, Kennecott Copper, Pluspetrol, London Mining Venture, Colorado Oil and Gas Commission, Asarco, RTG, Rocky Mountain Arsenal, U.S. Forest Service, Unocal, Occidental, Anadarko, Sunnyside Mining Company, ExxonMobil, Shell, Mountain Coal, Mid Continent Mining Company, Amax, Anaconda, Rocky Flats Environmental Technology Center, Eastman Kodak, CH2MHill, ERM, Versar, Lockheed Martin, Pueblo Munitions Depot, URS, Evergreen Resources, Union Pacific, Chevron, Petroperu, Perez Companc, and numerous municipalities in Colorado, New Mexico, Florida, Texas, Arizona, and North Dakota.

8. I have authored and co-authored scientific papers published in refereed journals dealing with the effects of contaminants in aquatic environments. I have prepared numerous environmental impact assessment reports for industrial operations in Peru, Argentina, Turkey, Bangladesh, and the United States. These reports have been prepared for activities in both aquatic and terrestrial environments. I have authored hundreds of reports detailing the results of WET testing of discharges from industrial and municipal operations. I have also conducted and reported on the results of sediment toxicity tests to determine the effects of industrial discharges. I have taught courses on aquatic toxicology and the effects of contaminants and presented scientific papers on these topics in both the U.S. and abroad. I have also been a reviewer of papers dealing with aquatic toxicology for the Journal of Environmental Toxicology and Chemistry. I am currently directing a study to investigate the effects of acid mine drainage in the Lefthand Watershed and recently completed sampling and testing of discharges from abandoned mines in Gamble Gulch west of Boulder, Colorado.

9. A true and correct copy of my resume is attached.

10. I have examined the NPDES permits for Teck Cominco's Red Dog mine and the Red Dog port site. I have also examined the Discharge Monitoring Reports (DMRs) for the mine and port sites from 1998 to 2002. I have also reviewed many of the letters from Teck Cominco to EPA admitting exceedances of Teck Cominco's NPDES permits. I have also reviewed Teck Cominco's Revised Opposition to KRPC's Motion for Partial Summary Judgment, and the declarations Teck Cominco submitted supporting that Opposition in the related case Kivalina Relocation Planning Committee v. Teck Cominco Alaska, Inc., No. A02-231 CV(JWS).

Testimony relating to Red Dog Mine and Port

11. WET testing is a proven method for monitoring discharges from industrial and municipal operations. The EPA conducted interlaboratory testing of the WET methods and found that they have a high rate of successful completion, do not often produce false positive results, and exhibit precision comparable to chemical methods approved at 40 CFR part 136. The following table shows the results of this testing which was performed by 56 laboratories across the country. The lab which I manage was one of the labs to perform in this exercise.

Table 1. Summary of Performance Characteristics for Ratified WET Methods. (Taken from: Guidelines Establishing Test Procedures for the Analysis of Pollutants; Whole Effluent Toxicity Test Methods; Final Rule, [Federal Register: November 19, 2002 (Volume 67, Number 223)], [Rules and Regulations, [Page 69951-69972]

Test method	Successful test completion rate (%)	False positive	Interlaboratory precision (%CV) rate
Ceriodaphnia dubia Acute Test	95.2	0.00	29.0
Ceriodaphnia dubia Survival and Reproduction Test	82.0	3.70	35.0
Fathead Minnow Acute Test	100	0.00	20.0
Fathead Minnow Larval Survival			

and Growth Test	98.0	4.35	20.9

12. Teck Cominco has attempted to argue that failure of one of the two strains used for WET testing should not be considered noncompliance. However, not all aquatic species are equally sensitive to contaminants. This is demonstrated in the table below which shows that the invertebrate (*Daphnia*) is in most cases more sensitive than fish to metals by factors ranging from 2-3 times to more than an order of magnitude. The 96-hr LC50 measures the concentration of a contaminant that is toxic to a test organism in a 96-hr exposure and is a common measure of toxicity. In the natural environment, any impacts on invertebrate communities can indirectly impact fish populations. That is why it is important to conduct WET tests using aquatic species of different types.

Table 2. 96-hr LC50 values in ug/l. [Taken from 1) Lankford, P.W. 1990. Removal of metals to nontoxic levels, pp 98-124. *In* Lankford, P.W. and W. Eckenfelder, eds. Toxicity Reduction in Industrial Effluents. Van Nostrand Reinhold, New York; 2) EPA ECOTOX Database; 3) USEPA Ambient Water Quality Criteria documents].

CONTAMINANT	FATHEAD MINNOW	*DAPHNIA*	RAINBOW TROUT
Arsenic	15600	1348	13340
Cadmium	30.5	48.1	4.3
Chromium (hexavalent)	43100	6400	69000
Copper	115.5	21.2	42.5
Lead	5000	975	471000
Mercury	159	3.2	275
Nickel	440	54	-
Selenium	1460	430	9000
Silver	0.012	0.002	0.023
Zinc	238	100	590

13. 40 CFR §122.45(d) requires that permit limits be expressed as an average monthly limit and a maximum daily limit. Chapter 5 of EPA's *NPDES Permit Writer's Manual* notes that "the daily maximum limitations are based on the assumption that daily pollutant measurements are lognormally distributed. Long-term average limitations are based on the distribution of averages of measurements drawn from the distribution of daily measurements. When designing a treatment system, EPA recommends that the permittee target the design of its treatment system to meet the long-term average rather than the daily maximum. The daily maximum is intended to account for variation in effluent concentration above the long-term average." A treatment system can be characterized by the long-term average (i.e. monthly average) and the variance (or coefficient of variation) and by assuming a particular statistical distribution (usually lognormal). Permit limits are generally set at the upper bounds of acceptable performance (Chapter 5 of the *NPDES Permit Writer's Manual*). Therefore, when a treatment system shows extreme upsets or varies widely around the long-term average, it is indicative of a poorly designed or operating system. In Teck Cominco's case, this was reflected in certain daily maximums that were so out of compliance that the monthly average was also violated.

14. A methodology for using the topsmelt, *Atherinops affinis*, in WET testing has been developed and published in *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms*, EPA/600/R-95/136, August 1995. The test protocol for this organism provides for adjusting the salinity of discharges to match that of the receiving water. Therefore, *A. affinis* was an appropriate test organism to be included in the NPDES permit for the Red Dog Port Site.

15. The aquatic system in the vicinity of the Red Dog Mine is a naturally stressed system due to the Red Dog mineralization. Discharges from the mine add contaminants which further add to this stress. For instance, the mine discharges ammonia in concentrations which can be toxic to fish. Other discharged contaminants which add to loading in the stream system include total dissolved solids and some metals. Testing of the mine discharge has shown consistent toxicity to fish and invertebrates. This stress added to that of the already stressed natural system can be expected to further impact downstream habitats over and above what can be expected in the absence of the discharge. This can be especially critical in periods of mine upsets.

16. Teck Cominco has consistently demonstrated a good correlation between conductivity and TDS measurements. Currently Teck Cominco measures conductivity downstream from the mine discharge, with TDS measurements at the pipe reported once a week. The TDS discharged from the mine is also much higher than the background levels in the aquatic system below the mine. Given these two factors, it is likely that fluctuations in TDS measurements at the mine will be reflected in conductivity measurements downstream.

17. Contaminants discharged in the Red Dog Mine effluent will enter downstream aquatic systems. These contaminants will represent a potential long-term source of contamination where they can impact aquatic communities and drinking water sources. Metals and cyanide(s) will be of particular concern in this regard.

Signed under penalty of perjury this 30th day of September at Louisville, Colorado.

Ken Fucik

KEN FUCIK
Aquatic Ecologist/Toxicologist

EDUCATION

Master of Science in Biological Oceanography, Texas A&M University, 1974
Bachelor of Science in Zoology, Texas Tech University, 1971

CAPABILITIES

Mr. Fucik has a broad range of experience in investigating environmental impacts in aquatic and terrestrial habitats throughout the U.S. and abroad over a more than 30 year career. He has directed or participated in projects on all of the U.S. coasts including Alaska and throughout the Rocky Mountain and Plains States. Internationally, he has directed projects in South America, Asia, and Europe. Mr. Fucik possesses training in both field and laboratory studies on the ecological and physiological effects of contaminants on marine and freshwater environments. He has directed major remediation/reclamation projects in sensitive habitats ranging from mountainous areas to coastal systems and tropical rainforests. Since 1994, Mr. Fucik has directed and/or participated in the preparation of 15 EIA's around the world. Mr. Fucik has started and/or managed several environmental chemistry and toxicology labs in the U.S., Australia, and South America since 1987 and is currently President of the Board for Envirolab-Peru, an analytical lab in Lima, Peru. He was an appointed member of a county committee charged with recommending Superfund status for active and historical mining operations in the Lefthand Watershed in Colorado and is currently a board member of the watershed oversight group.

Mr. Fucik has authored numerous reports and scientific papers on topics involving the effects of contaminants in aquatic environments. He has been an invited lecturer and given training on topics involving dispersants usage and aquatic toxicity testing. He is also a reviewer of scientific papers dealing with toxicology topics for the Journal of Environmental Toxicology and Chemistry and the Journal of Marine Research.

EXPERIENCE

August 1987 to Present: General Manager - The SeaCrest Group

Representative experience: Has directed and/or participated in water quality assessments throughout the U.S. and abroad. Directs aquatic toxicology laboratory annually conducting hundreds of acute and chronic aquatic and sediment bioassays for NPDES monitoring and water quality assessments. Directed toxicological investigations to assist engineering companies involved in designing treatment facilities for the Yak Tunnel, Argo Tunnel and the Summittville Mine Superfund sites. Assessed environmental and human health impacts following a gas well blowout in Bangladesh. Developed Environmental Management Program for solids wastes, drilling wastes, water quality, and air for a client's operations in Bangladesh. Conducted an aquatic habitat survey to determine effects of mine discharges on the Crystal River, Colorado. Measured recovery of a river following mine reclamation efforts near St. Mary's Glacier, Colorado. Directed preparation of 15 EIA/s and other permitting documents for seismic, exploration, and development of oil and gas resources in South America, Asia, Africa, and Middle East. Participant in a Natural Resource Damage Assessment for an oil spill off the California

coast. Managed several laboratory investigations to evaluate the effects of oil and dispersed oil on the eggs and larvae of fish and invertebrates in the Gulf of Mexico and Java Sea off Indonesia. Conducted field and laboratory studies to evaluate the effects of produced waters from offshore and onshore drilling operations on human health and the environment. Performs toxicity reduction evaluations on wastewater discharges from municipal discharges, mining operations, oil and gas operations, and manufacturing facilities to determine causes of toxicity. Conducted an ecological survey and mapped sensitive biological and human habitats along the Yellowstone and Little Missouri Rivers as part of an oil spill response plan for petroleum production operations. Investigated microbial degradation of petroleum hydrocarbons in groundwaters. Directed a feasibility study for remediating and reclaiming impacted areas in the Amazonian rainforest. Directed aquatic surveys to determine environmental impacts of produced water discharges on rivers in the Peruvian Amazon. Directed a feasibility study for treating fishmeal wastes and developing secondary aquaculture operations on Peruvian coast. Taught a course on toxicology and risk assessment in Ecuador to 23 participants from 10 Central and South American countries.

September 1982 to Present: Continental Shelf Associates

Provides technical support on toxicological issues particularly as it relates to discharges of muds and cuttings and produced waters. Developed the construction and operations monitoring plans for a major oil and gas development in Sakhalin, Russia. Prepared the Coast Guard application for a LNG regasification project in the Gulf of Mexico. Provided technical expertise to review the food chain effects of cutting piles in the North Sea. Participant in hard bottom surveys and environmental impact assessments (EIAs) for oil and gas lease tracts off California, Alaska, and Florida. Prepared environmental assessments for proposed dams at two locations in Texas. Directed a study of 120 potential mitigation sites along the Texas coast in seagrass, wetland and oyster reef habitats. Prepared permitting documents for proposed sewage outfalls off South Florida coast. Reviewer and contributor to oil spill response plans and dispersed oil monitoring plans for several oil and utility company clients. Participant in project to review and critique MIRG Oil Spill Response Model.

September 1977 to August 1982: Science Applications Inc. - Biological Oceanographer

Provided biological expertise on multidisciplinary study to synthesize environmental data for Alaskan offshore and coastal water prior to oil and gas leasing. Participated in primary productivity studies of two Alaskan wetlands. Participant in NOAA's Damage Assessment Team charged with designing environmental damage assessment studies following IXTOC oil spill in Bay of Campeche. Directed study to synthesize results to determine effects of oil and gas production in Buccaneer Field off Galveston, Texas. Conducted study to determine role of mathematical models for wetlands investigations for Corps of Engineers. Directed preparation of an oil spill response plan for oil and gas producer in Mobile Bay, Alabama.

May 1974 to August 1977: Texas A&M University - Research Associate

Conducted field and laboratory investigations on the fate and effects of oil in the marine environment.

September 1972 to May 1974: Texas A&M University - Graduate Student

Investigated the effects of oil and gas production on the phytoplankton ecology in the Louisiana offshore.

PUBLICATIONS

Representative publications include:

Fucik, K. 1992. Toxicity identification and characteristics of produced water discharges from Colorado and Wyoming, pp 187-198. In Ray, J.P. and F.R. Engelhardt (eds.), Produced Water: Technological/Environmental Issues and Solutions. Plenum Press, New York. 616 pp.

Fucik, K. (principal author). 1991. The role of biomonitoring in measuring reclamation success at a hazardous waste site, pp. 212-222. In M.A. Mayes and M.G. Barron, (eds.) Aquatic Toxicology and Risk Assessment: Fourteenth Volume. ASTM, Philadelphia, PA. 383 pp.

Fucik, K. (co-author). 1984. Ecological considerations for the use of dispersants in oil spill response, pp. 363-377. In: T.E. Allen (ed.), Oil Spill Chemical Dispersants: Research, Experience, and Recommendations. ASTM Special Publication 840, ASTM, Philadelphia. 465 pp.

Fucik, K. (principal author). 1984. Measurements of damage, recovery, and rehabilitation of coral reefs exposed to oil. In: J. Cairns and A. Buikema (eds.), Restoration of Habitats Impacted by Oil Spills. Butterworth Publishers, Stoneham, MA.

Fucik, K. (co-author). 1983. The food habits of juvenile salmonids of two Alaska marshes. Estuaries 2: 102-114.

Fucik, K. and I. Show. 1981. Environmental synthesis using an ecosystems model, pp. 329-354. In: B.S. Middleditch (ed.), Environmental Effects of Offshore Oil Production. The Buccaneer Gas and Oil Field Study. Pergamon Press, New York.

Fucik, K. (co-author). 1979. Physiological basis of differential sensitivity of fish embryonic stages to oil pollution, pp. 85-108. In: F.J. Vernberg, W.B. Vernberg, and A. Calabrese (eds.), Marine Pollution: Functional Processes. Academic Press, New York.

Fucik, K. and S. El-Sayed. 1979. Effect of oil production and drilling operations on the ecology of phytoplankton in the OEI study area, pp. 325-353. In: C.M. Ward, M.E. Bender, and D.J. Reish (eds.), The Offshore Ecology Investigation. Effects of Oil Drilling and Production in a Coastal Environment. Rice University Series, Vol. 65. Rice University, Houston, TX.

Fucik, K. and J. Neff. 1977. Naphthalene uptake by the temperate clam, *Rangia cuneata*, and the boreal clam, *Prototheca staminea*, under varying conditions of

temperature and salinity, pp. 305-312. In: D.A. Wolfe (ed.), Fate and Effects of Petroleum Hydrocarbons in Marine Organisms and Ecosystems. Pergamon Press, New York.

Fucik, K. (principal author). 1977. The uptake of naphthalenes by the clam, *Rangia cuneata*, in the vicinity of an oil spill separator platform in Trinity Bay, Texas. In: Proceedings, 1977 Oil Spill Conference (Prevention, Behavior, Control, Cleanup).

Fucik, K. 1974. The effects of petroleum operations on the phytoplankton ecology of the Louisiana coastal waters. M.S. Thesis, Texas A&M University. 82 pp.

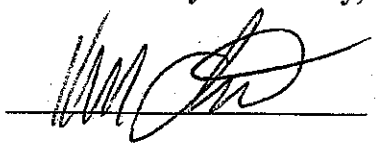
REBUTTAL REPORT OF KEN FUCIK

In the United States District Court for the District of Alaska at Anchorage

Adams et al v Teck Cominco Alaska Incorporated

Case No. A04-49 CV (JWS)

Signed this 10th day of January, 2005



EXPERT REPORT OF KEN FUCIK

In the United States District Court for the District of Alaska at Anchorage

Adams et al v Teck Cominco Alaska Incorporated

Case No. A04-49 CV (JWS)

Introduction and Summary of Opinions

1. This report summarizes the bases for the opinions I propose to provide in this matter. In summary, my opinions are:

a) Teck Cominco committed violations of its NPDES permit for cadmium, total dissolved solids, cyanide, and whole effluent toxicity (WET) at the Red Dog Mine between August 1998 and May 2003.

b) These violations occurred as a result of Teck Cominco's failures to adequately treat the discharge from the mine , and allowed release of contaminants that were environmental as well as human health risks.

c) Releases of contaminants from the Red Dog Mine caused increased loading of contaminants to the environment which likely contaminated both waters and sediments.

d) As a result of the unlawful releases, the ecological system downstream from the mine was injured and the citizens of Kivalina were exposed to contaminated fish and drinking water.

e) Teck Cominco performed inadequate studies to identify and address the environmental and human health risks to the region.

2. In forming my opinions, I have reviewed:

a) Expert reports of Kevin Brix, Joyce Tsuji, Gene Andrews, and Michael Botz

b) Various EPA Guideline documents dealing with WET testing and regulations relating to the Clean Water Act;
c) EPS Integrated Risk Information System
d) National Water Quality Criteria guidance documents
e) EPA Guidance for Assessing Chemical Contaminant Data for Use In Fish Advisories
f) Technical reports provided in the reference section at the end of this report
g) DMR reports from the Red Dog Mine
h) Expert report prepared by Robert Moran

Summary of Information Forming the Basis for My Opinions

3. The NPDES permit for the Red Dog 001 discharge includes numerical limits and monthly monitoring for pH, turbidity, hardness, aluminum, cadmium, copper, chromium, iron, lead, manganese, mercury, nickel, selenium, silver, zinc, total dissolved solids (TDS), total suspended solids, cyanide (total and WAD), fecal coliforms, total residual chlorine, BOD, and ammonia nitrogen. The permit also has a requirement to conduct whole effluent toxicity testing (WET).
4. Whole effluent toxicity testing (WET) has been used for almost 20 years as a means to measure and control toxic substances in NPDES permitted wastewaters from industrial and municipal discharges. The basis of WET testing was established in the Declaration of Policy and Goals of Section 101 (a)(3) of the Clean Water Act when it stated that "it is the national goal that the discharge of toxic pollutants in toxic amounts be prohibited". The WET test methods were codified by EPA in a final regulation on October 16, 1995 (60 FR 53529). The agency-approved methods are specified in 40 CFR 136.
5. The value of WET testing is that it allows for monitoring of discharges that are complex and have the potential to contain a wide range of contaminants that may or may not be individually present in toxic

amounts. The final rule for WET testing in 40 CFR 136 stated that "effluent limitations on specific compounds do not necessarily provide adequate protection for aquatic life when the toxicity of effluent components is not known, effects of effluent components are additive, synergistic, or antagonistic, and/or when an effluent has not been chemically characterized".

6. Two recent papers document the presence of most of the constituents listed below in the Red Dog rocks (Slack et.al., 2004a and b). Other chemical constituents not mentioned in the Slack papers are listed below because they are almost always present in metal mine effluents. Confirmed and or/suspected constituents in the rocks include aluminum, antimony, arsenic, barium, cadmium, copper, chromium, cobalt, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, zinc, calcium, magnesium, sodium potassium, sulfate, nitrate, ammonia, boron, phosphorus, fluoride, chloride and natural radioactive constituents (e.g. uranium, thorium, potassium-40, and gross alpha and beta).
7. Chemical reagents used in processing of the ore include methyl isobutyl carbinol, potassium ethyl xanthate, sodium ethyl ether, potassium amyl xanthate, sodium isobutyl xanthate, sodium metabisulfite, zinc sulfate, copper sulfate, sodium cyanide, sodium sulfide, lime, sodium hydroxide, organic antiscalants and flocculents (correspondence: James Kulas, T-C to Enoch Adams, Jr., Oct. 11 and 13, 2002). About 155 tons per year of sodium cyanide is used and this generates numerous cyanide and related breakdown compounds (metal-cyanide complexes, cyanate, thiocyanate) as wastes. In addition, the mine utilizes large quantities of explosives (i.e. ammonium nitrate-fuel oil, dynamite, etc.) and fuels (diesel, gasoline, kerosene), oils and lubricants, the residues of which are routed into the mine wastes and then to the treatment plant.
8. Between 1998 and 2002, the mine discharge violated permit limits for total dissolved solids, cyanide, and cadmium. WET limits have also been

violated during this period. Numerical and WET limits have been established for the mine on the basis of instream conditions so as to be protective of water quality and aquatic life. Therefore, when such limits are exceeded, it is reasonable to expect that injury to the natural system has occurred.

Rebuttal to the Expert Report of Kevin Brix

9. Kevin Brix misinterprets his own assessment data for cadmium (Expert Report of Kevin Brix, Paragraph 16) to assert that the "effluent is actually providing a substantial benefit to aquatic life downstream of the discharge…". Mr. Brix acknowledges that "the permit limit for cadmium is based on water concentrations that are protective of aquatic life" (Expert Report of Kevin Brix, Paragraph 9). Exceedances of the limit would indicate a potential for impacting the environment, not improving it. Additional loading of cadmium and other chemical constituents into the system is occurring as a result of the discharge from the Red Dog Mine. Inputs that add more of a toxicant to a system through loading will not reduce toxicity. Loading refers to the mass of a substance that is being added to the Red Dog Creek. Mass loading can have more significance in creating impacts than concentrations. Mr. Brix does not take into account that the discharge is adding more mass of contaminants to the system. This means that the cadmium being added to the system through the Red Dog discharge is further adding to concentrations in the sediments and being made available to downstream waters. Mr. Brix's arguments in his assessment fail to recognize that Teck Cominco has identified only a portion of the possible contributors of toxicity in the discharge. Cadmium is only one of many possible toxic contaminants in the system. EPA has stated: "When whole effluent toxicity testing is used, toxicity itself is a pollutant parameter. The toxicants creating that toxicity need not be specifically identified to limit the effluent's toxicity" *(Whole Effluent*

Toxicity: Guidelines Establishing Test Procedures for the Analysis of Pollutants, [Federal Register: October 16, 1995 (Volume 60, Number 199)]. To properly conduct a risk assessment to look at stream impacts from a discharge requires that all possible contributors to toxicity be calculated and summed. Mr. Brix looked only at cadmium in spite of the fact that the discharge is a complex effluent that contains many monitored and unmonitored components. Under EPA's definition, the toxicity in the WET test is a pollutant parameter which has to become a part of any risk assessment. In testing conducted in 2003, Teck Cominco could only account for about 50% of the toxicity in the discharge (Bates #TC 012837 RD, TC 012900 RD, TC 012968 RD, TC 013047 RD). This 50% of the toxicity was attributed to total dissolved solids. There is another 50% of the effluent toxicity which must be considered as a risk to the environment.

10. It is a gross misstatement for Mr. Brix to claim that the "effluent is providing a substantial benefit to aquatic life downstream of the discharge" (Paragraph 16). The WET test is a violation of the Clean Water Act. No violation of water quality standards can be construed to provide a benefit to the environment.

11. In his expert report, Mr. Brix evaluates the impacts of TDS from the discharge. TDS is a meaningless term when trying to predict or explain toxicity. TDS is a general measure of the chemical constituents in water. More important than the actual measure of TDS are the actual constituents which make up the TDS. TDS can have significant ecological impacts. Excessive TDS levels can make waters unsuitable for drinking and affect agricultural production when applied in irrigation. The amount of contaminant loading in the aquatic system as a result of TDS discharges from the Red Dog mine has increased from approximately 67,000 pounds per day in the pre-mining period to as much as 809,000 pounds per day in 1995. In 2003, daily input ranged from 274,000 to 780,000 pounds per day. The significance of this loading cannot be overlooked when

evaluating the risks of the discharge in producing downstream impacts from the Red Dog discharge. To assume that a system that has acclimated to a loading of 67,000 pounds per day can absorb 4-10 times that much without evaluating all of the possible inputs and the risks of those inputs is not good science.

12. Teck Cominco has not determined the fate of the discharges from the Red Dog Mine. The sediments are a sink for most contaminants that enter aquatic systems. It is likely that much of the discharged material has precipitated and been deposited in the bottom sediments (i.e. bottom substrate) where it accumulates and becomes a long-term source of impact. This can directly affect benthic organisms through alteration of habitat and/or community structure. Arctic grayling and dolly varden deposit their eggs on the bottom where they remain exposed to the sediments for periods ranging from 13-18 days for Arctic grayling and up to 4-5 months for the dolly varden. These embryos will be at risk to impact from exposure to the altered sediments resulting from the mine discharge.
13. Kevin Brix makes further claims that cyanide is not a factor in causing toxic contributions to the stream without producing any data to substantiate his claims. This is in spite of the fact that the mine has been cited for violations for exceeding its cyanide limits and in spite of the fact Teck Cominco has only been able to account for 50% of its toxicity in the WET test. Until it can be proven otherwise, cyanide has to be considered one of many possible contributors of toxicity in the mine discharge.
14. Kevin Brix' expert report states that metals, cyanide, and milling reagents have been eliminated as causing toxicity in the discharge (Paragraph 34). However, no data have been provided showing how these conclusions were reached. These data have been requested from Teck Cominco by the Plaintiff's counsel.
15. Under its NPDES permit, Teck Cominco is required to identify and treat all sources of toxicity in its discharge. It should be noted that even though

Teck Cominco's discharge does not always exceed its WET permit limits, a passing WET test does not mean Teck Cominco is not discharging toxic materials. In fact, Teck Cominco is reporting a toxic response in every WET test it conducts. During a month when the discharge passes, this generally averages approximately 6 toxic units (t.u.'s). This level of toxicity is indicative of a highly toxic mixture when considered by itself. This equates to a mixture that is toxic at a concentration of only 17% of the effluent. Violations occur at concentrations equivalent to 9.7 t.u.'s or a concentration of about 10-11% effluent. This represents a chronic and continuing discharge of toxics into an environment whose carrying capacity to absorb the load of a complex mixture of contaminants has not been determined. Teck Cominco's assessment of risks from cadmium and cyanide did not take into account the long-term impacts of these toxic inputs to the system.

16. In his expert testimony, Mr. Brix challenges the use of *Ceriodaphnia dubia* as being representative of resident biota of the Red Dog ecosystem. This is a misinterpretation of WET testing objectives and reasons for *Ceriodaphnia* being selected as the species of choice for WET testing. In reality, there is no one species that would ever be representative of every aquatic habitat in the U.S. Rather, *Ceriodaphnia* is a species that has moderate sensitivities to most contaminants, is easy to culture, and has a short life span which allows it to be used in chronic type investigations. EPA does allow the use of alternative species in WET testing. This is specified in Section 6.1.5 of *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition, October 2002*. However, it should also be noted that this section says: "*Where states have developed culturing and testing methods for indigenous species other than those recommended in this manual, data comparing the sensitivity of the substitute species and the one or more recommended species must be obtained in side-by-side toxicity tests with reference toxicants and/or effluents, to ensure that the*

species selected ***are at least as sensitive*** *as the recommended species*" (**Bolding** added). Any other species which is used would show the same type of response as the *Ceriodaphnia*. Therefore, there is no basis for Teck Cominco to make the claim that its WET tests are overpredicting the potential for impacts on aquatic life as claimed in Keven Brix' expert testimony (Paragraph 35).

17. In his expert report, Kevin Brix challenges the accuracy of WET tests conducted by Teck Cominco prior to 2003 (Paragraph 39). However, the accuracy of WET tests were addressed in EPA's July 2000 guidance document *Method Guidance and Recommendations for Whole Effluent Toxicity (WET) Testing(40 CFR Part 136),* EPA-B-00-004 and was available to Teck Cominco at the time of their tests. In addition, this document included guidance for reporting on tests that provided anomalous results that could falsely identify toxicity and for the addition of test dilutions to improve accuracy of suspected results. It also provided for the use of receiving water as dilution water when the objective was to determine the toxicity of an effluent in the receiving system. To our knowledge, Teck Cominco did not avail themselves of this guidance and opportunities to improve their tests. Therefore claims that testing is invalid and the results are inaccurate in measuring toxicity have no merit.
18. In his expert report, Kevin Brix claims that only substantial changes have validity in assessing impacts in a system. The preponderance of the evidence indicates that impacts have indeed occurred. This is demonstrated by the fact that violations of limits for cyanide, cadmium, TDS, and WET have all occurred. Each of these limits was established to protect water quality and aquatic life and to meet the Clean Water Act's national goal that "the discharge of toxic pollutants in toxic amounts be prohibited". The lack of ability to determine the nature of the toxicity from the Red Dog effluent and the sheer amount of loading that is occurring on a daily basis in the watershed makes any statement denying possible effects of the discharge to be without merit.

19. Water quality limits have been established to protect human health and aquatic life. The EPA established the NPDES permit system as a means to administer the objectives of the Clean Water Act. NPDES permits establish compliance with the Clean Water Act at the point of release into the environment. When established water quality limits are exceeded at the point of release, then a threat to human health and the environment exists. The amount of loading from the Red Dog discharge indicates that this threat has probably been reflected in impacts to the waters and sediments of the watershed.

Rebuttal to the Expert Report of Joyce Tsuji

20. As described in Paragraphs 3 and 4 of this report, the discharge from the Red Dog Mine has the potential to contain a wide range of toxic constituents. Some of the contaminants discharged from the Red Dog mine have been assigned water quality limits under Section 304(a) of the Clean Water Act. A larger percentage of the constituents in the Red Dog discharge have not been assigned water quality limits and/or are not monitored. The lack of an established standard does not mean that a particular contaminant does not have human health effects. Lack of a requirement to monitor also does not mean that a contaminant is not present. As already demonstrated, Teck Cominco has only been able to account for 50% of the toxicity present in the WET tests.
21. Teck Cominco's discharge represents a potential health risk to the citizens of Kivalina who take their water from the Wulik River. The residents of Kivalina also take and eat fish from the Wulik River and Ikalukrok Creek. The Ikalukrok receives drainage from Red Dog Creek. Fish have the ability to accumulate the organic and inorganic toxicants discharged from the Red Dog mine. Exposed fish can uptake the toxicants directly from the stream waters or from their food sources that can also accumulate the toxicants.

22. The residents of Kivalina are exposed to contaminants from the Red Dog mine through their drinking water or their food including fish. Joyce Tsuji evaluated the risks to the residents of Kivalina from cyanide, cadmium, and TDS. However, these are only a few of many contaminants in the Red Dog discharge. As described in Paragraph 3 and 4 of this report, the discharge from the Red Dog mine includes a wide range of organic and inorganic contaminants, most of which are not monitored. WET tests produced violations of the Red Dog mine NPDES permit. EPA considers the effluent used in the WET tests to be a "pollutant" (i.e. having the same status as an individual contaminant which violates limits). Teck Cominco has accounted for only 50% of the sources of toxicity in the WET samples. It is possible that some of the unidentified toxicants causing WET violations are also toxic to humans. Risk assessment protocols include summing risks from all possible threats. Ms. Tsuji limited her assessments to only cyanide, TDS, and cadmium when it should have considered the much broader range of contaminants potentially present in the system, especially since EPA has assigned a failing WET test as a pollutant no different than a specific contaminant.
23. In performing her assessment of risks from the Kivalina water system, Ms. Tsuji based it upon water that was stored in the system in August 2002 but was not analyzed until December 2002. Technically, this was not a representative sample of what the residents are exposed to in the summer months when the mine is discharging. From an analytical standpoint, holding times for waters stored in August had been exceeded for all contaminants in the discharge by the time the analysis was done in December. Therefore, while a case could be made that this was the water Kivalina residents drink during the winter, it is not valid as a sample to represent summertime usage.
24. Joyce Tsuji also conducted an evaluation of risks on the community of Kivalina from fish. This assessment was based on Dolly Varden collected from the Wulik River in the spring and fall. She reported that cadmium

was found in liver and other organs but not in fish tissue. She did not report on risks associated with other contaminants discharged from the Red Dog mine even though these are known to be numerous.

25. Ott and Morris (2004) reported on their results of whole body metals analysis of Dolly Varden in the Red Dog drainage in 2002. They compared tissue concentrations of cadmium, lead, selenium, and zinc from fish from the Red Dog drainage and other streams in Alaska. The Mainstem Red Dog was the only stream to score high on all of the sampled metals. Also, while the average concentration of cadmium in Dolly Varden in 2002 was less than that measured in baseline investigations in 1981 before the beginning of mining (Dames and Moore 1983), concentrations of lead and zinc in the fish tissues were much higher in 2002 than before mining began. Ott and Morris (2004) also found high levels of selenium in the fish. Selenium was not monitored in the 1981 study. These contaminants were not considered in Joyce Tsuji's assessment. Ms. Tsuji also did not report on the potential risks to human health from fish obtained in Red Dog Creek below the mine or the Ikalukrok Creek. During their lives, Dolly Varden and other fish below the Red Dog mine will migrate up and down the rivers where they will be exposed to the effluent from the mine. Since the Kivalina residents will eat these fish, any assessment of risks should have taken this into consideration. Combined with her failure to consider other toxicants discharged from the mine and the failure to look at a representative water sample, the assessment conducted by Joyce Tsuji was incomplete and did not adequately treat the potential risks to the Kivalina citizens.
26. The fact that I have focused only on certain statements in the report of Kevin Brix and Joyce Tsuji does not reflect my acceptance or agreement with those statements not specifically addressed here.
27. I reserve the right to modify and supplement my opinions as further information becomes available, including through deposition of defendant's experts, and to express new opinions in response to new

information or to opinions expressed by defendant's experts. Additionally, I have not been given access to several of the reports and publications on which Kevin Brix and Joyce Tsuji relied in making their expert opinion; I have been informed by plaintiffs' counsel that these documents were requested of Teck Cominco but have not been provided to plaintiffs. I reserve the right to modify and supplement my opinions once I have been provided all data and publications on which defendant's experts relied.

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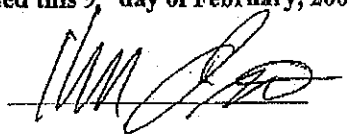
SUPPLEMENTAL COMMENTS OF KEN FUCIK TO KEVN BRIX REPORT

In the United States District Court for the District of Alaska at Anchorage

Adams et al v Teck Cominco Alaska Incorporated
Case No. A04-49 CV (JWS)

Signed this 9th day of February, 2005



Supplemental Response to the Report of Kevin Brix
Preliminary Report on the Effects of Total Dissolved Solids
On Arctic Grayling

In the United States District Court for the District of Alaska at Anchorage

Adams et al v Teck Cominco Alaska Incorporated
Case No. A04-49 CV (JWS)

Introduction and Summary of Opinions

1. This report summarizes my comments on the supplemental expert report of Kevin V. Brix titled "Report on the Effects of Total Dissolved Solids on Arctic Grayling and Dolly Varden" and dated December 2004.

a) The report summarizes testing that was done on the fertilization success of Arctic Grayling and Dolly Varden eggs exposed to a series of TDS concentrations during May and September 2004.
b) The above-mentioned report was prepared by Kevin Brix and Martin Grosell and submitted to Mark Thompson at TeckCominco.

Summary of Information Forming the Basis for My Opinions

1. The Introduction for the report specifies that the "study consisted of laboratory experiments to develop dose-response relationships for TDS exposed embryos". In actuality, the test measured fertilization success as opposed to embryo survival or hatching success. While fertilization rate is one potential measure of the impacts of a contaminant, a high rate of success does not indicate that effects in the environment are absent.

Actual exposure of the embryos in this test was only 24 hours for the Dolly Varden and 72 hours for the Arctic grayling. In the Red Dog environment, the fertilized embryos would be chronically exposed to elevated levels of TDS extending for as long as 13-18 days for the Arctic grayling and 4-5 months for the Dolly Varden.

2. The tests produced variable results that even the authors indicated required further testing. It is not possible to rely on any specific conclusions at this time regarding the results of the study.
3. The authors concluded that the Dolly Varden studies were more conclusive than the Arctic grayling ones. In my opinion, the data do not show this. The Arctic grayling studies had good dose responses in two tests with two tests showing minimal effects. All tests resulted in >80% control fertilization whereas only 63% of the Dolly Varden tests had control fertilization >80%. The Dolly Varden also had more anomalous results which are difficult to explain at best.
4. The results do not provide a good indication of the true effects of TDS on fertilization. If the Arctic grayling results are to be accepted, one would conclude that potential for effects from moderate to high levels of TDS are possible. If the Dolly Varden results are to be accepted, one could also conclude that under some situations, impacts could occur from low to intermediate concentrations of TDS (as shown in Tests 5 and 8). Similarly, for both species, one could conclude that in other cases, no effects would be observed. Based on these data, regulators should err on the side of conservatism to require a lower TDS limit and to protect aquatic life upon which the native populations depend.
5. In evaluating the effects of the Red Dog Mine, it has to be remembered that the discharge from the mine is a complex mixture of TDS as well as other potential contaminants. The sum of these contaminants is what determines the overall level of effects in the environment. Teck Cominco's previous studies have shown that there can be from 4.9-35.7 Toxicity Units in the discharge (Brix 2003), only about half of which have

been attributed to TDS. The overall effects of the discharge on fertilization success, hatching success, embryo survival and growth, or any other parameters will only be known when the contribution of each contaminant present in the discharge is accounted for.

References

Brix, Kevin B. 2003. Analysis of historical whole effluent toxicity data for Teck Cominco's Red Dog Mine. Report to Teck Cominco. 15 pp.